HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Big Quilcene River Summer Chum Salmon Supplementation
Species or Hatchery Stock:	Summer chum salmon, *Oncorhynchus keta*, Quilcene stock
Agency/Operator:	U.S. Fish and Wildlife Service
Watershed and Region:	Big Quilcene River, Hood Canal, Puget Sound, Washington State
Date Submitted:	October, 1999
Date Last Updated:	March 27, 2001

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of Program

Quilcene National Fish Hatchery;
Big Quilcene River summer chum supplementation,
Big Beef Creek summer chum reintroduction**.**

1.2) Population (or stock) and species

Summer chum salmon, *Oncorhynchus keta*, Quilcene Stock

1.3) Responsible organization and individual:

Name(and title): Ron Wong, Hatchery Manager
Organization U.S. Fish and Wildlife Service
Address: 281 Fish Hatchery Road
Telephone: 360-765-3330
Fax: 360-765-3398
Email: Ron_Wong@fws.gov

Other organizations involved in the program:

Washington Department of Fish and Wildlife

1.4) Location(s) of hatchery and associated facilities:

Quilcene NFH, on-station: Washington, Hood Canal, Jefferson County,
rivermile 2.8 of Big Quilcene River
PSC hatchery location code 3F10412 170012 H
WRIA 17.0012
Big Beef transfer: Washington, Hood Canal, Kitsap County, Big Beef Creek,
PSC hatchery location code 3F10412 150389 H
WRIA 15.0389

1.5) Type of program:

Integrated Recovery

1.6) Purpose (Goal) of program:

The goal of this program is to aid in the conservation and recovery of threatened summer chum salmon in the Big Quilcene River and Big Beef Creek.

1.7) Specific objective(s) of program

Big Quilcene River - rebuild run to 1974-78 levels (3,152 naturally spawning adults)
Big Beef Creek - rebuild run to 1974-78 levels (839 naturally spawning adults)

1.8) List of Performance Indicators designated by "benefits" and "risks"

Produce adults that will return to successfully spawn in the natural environment.

1. All hatchery-origin summer chum fry will be marked with an adipose fin clip to allow for distinction from natural-origin fish upon return as adults in fisheries, at the hatchery rack, and on the spawning grounds.
2. Spawning ground surveys will be conducted throughout the summer chum return to count spawners, and to collect information regarding fish origin according to adipose fin clip observation, and age class composition through scale sampling.
3. The number of naturally spawning hatchery-origin summer chum that contribute to the supplemented population's annual escapement will be estimated.
4. Escapements of nearby non-supplemented populations will be monitored to determine the level of straying of supplementation program-origin fish to those drainages.
5. The total recruitment (fisheries contribution and escapement) of supplementation program origin chum will be estimated. Survival rate estimates of hatchery fish will be compared with estimates for wild fish to measure the effectiveness of each program.

Conserve the genetic and life history diversity of the target population.

1. The number of adults used in the supplementation program will meet or exceed the minimum effective population size.
2. Genetic stock identification (GSI) allozyme collections of summer chum spawners will be continued for comparison with past collections to monitor changes in allelic characteristics, and with the intent to assess whether the supplementation program has negatively affected the genetic diversity of natural populations.
3. DNA samples will be collected and archived for future analysis.
4. Natural spawner abundance and distribution of wild and hatchery-origin fish will be monitored. Spawner densities will be determined and locations of preferred areas identified. Annual and long-term changes in spawning distribution of the populations will be determined.
5. Spawning ground distribution, timing, and use by hatchery-origin fish will be compared to traits exhibited by wild-origin spawners.

Determine the need for and methods for improvement of supplementation or reintroduction operations or, if warranted, the need to discontinue the program.

1. All hatchery summer chum juveniles produced through the program will be adipose fin clipped to allow for assessments of contribution and natural origin recruitment rates.
2. We will determine the fry survival for each program at various life stages by:
    a. Monitoring growth and feed conversion for summer chum fry.
    b. Determining green egg to eyed egg, eyed egg to swim-up fry, and swim-up fry to released fry survival rates for summer chum.
    c. Maintaining and compiling records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for chum broodstock; fish and egg condition at time of

spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for one gram fry.

d. Summarizing results of tasks for presentation in annual reports.
e. Identifying where the supplementation program is not meeting objectives, and make recommendations for improved fry production as needed.

3. We will determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish by:
    a. Monitoring operation of adult capture operations, ensuring compliance with established broodstock collection protocols .
    b. Monitoring timing, duration, composition, and magnitude of the run.
    c. Collecting biological information on collection-related mortalities and determine causes of mortality, and use carcasses for genetic stock profile sampling, if possible.
    d. Summarizing results for presentation in annual reports and providing recommendations on means to improve broodstock collection, and refining protocols if needed for application in subsequent seasons.
4. We will monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists of the USFWS will monitor fish health.
    a. Fish health monitoring is conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.
    b. The incidence of viral pathogens in summer chum broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (WDFW 1996).
    c. Recommendations on fish cultural practices will be provided on a monthly basis, based upon the fish health condition of chum fry.
    d. Fish health monitoring results will be summarized in the annual report.

Collect and evaluate information on adult returns.

Through consideration of the results of the above, and through the collection of information required under adaptive management criteria used as the basis for determining when to stop a supplementation or reintroduction program.:

1. We will collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock for use as baseline data to document any phenotypic changes in the populations.
2. Commencing with the first year of returns of progeny from known naturally-spawned, hatchery-origin summer chum, we will evaluate results of spawning ground surveys and age class data collections to:

a. Estimate the abundance and trends in abundance of spawners;
b. Estimate the proportion of the escapement comprised by chum of hatchery lineage, and of wild lineage;
c. Through mark sampling, estimate brood year contribution for hatchery lineage and wild-origin fish.

Using the above information, we can determine whether the population has declined, remained stable, or has been recovered to sustainable levels.

3. We will compare newly acquired electrophoretic analysis data reporting allele frequency variation of returning hatchery and wild fish with baseline genetic data to determine if there is evidence of a loss in genetic variation (not expected from random drift) that may have resulted from the supplementation program.

1.9) Approximate expected size of program

Big Quilcene River, up to 389,000 fed fry released on-station
Big Beef Creek, up to 104,000 fed fry equivalents transferred as eyed eggs

Recommended initial annual summer chum fry supplementation program production levels needed to produce adult returns equal to historical (1974-78) average run sizes. (Summer Chum Salmon Conservation Initiative 2000)

Watershed	1974-78 Average Run Sizes 1/	Fed Fry Survival Rate 2/	Annual Fry Supplementation Level (1000s) 3/
Big Quilcene R.	3,152	0.81 - 1.63 %	**193 - 389**
Little Quilcene R.	1,418	0.81 - 1.63 %	**87 - 175**
Big Beef Ck.	839	0.81 - 1.63 %	**51 - 104**

Specify expected releases, adult fish harvested, and escapement goals. For existing program, provide additional historic data for three generations, or for the number of years of available and dependable information.

1.10) Date program started or is expected to start:

Big Quilcene River - Summer 1992
Big Beef Creek - Summer 1996

1.11) Expected duration of program:

three generations, 12 years

1.12) Watersheds targeted by program:

Big Quilcene River and Big Beef Creek

SECTION 2. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

2.1) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. Indicate whether this HGMP is consistent with these plans and commitments, and explain any inconsistencies.

The supplementation program is consistent with the co-managers' Summer Chum Salmon Conservation Initiative, Attachment 12D. Quilcene NFH operates within the co-managers' agreed fish production plan of the Hood Canal Salmon Management Plan, which is part of the Puget Sound Salmon Management Plan; a court ordered plan resulting from *U.S. v. Washington*.

2.2) Status of natural populations in target area.

For "integrated" programs (i.e., supplementation programs or other programs that involve close integration with a specific natural population), identify the natural population targeted for integration.

2.2.1) Geographic and temporal spawning distribution.

Spawning occurs primarily in the lower 1.5 miles of Big Quilcene River, from August 15 through October 15 (extremes).

2.2.2) Annual spawning abundance for as many years as available.

(Summer Chum Salmon Conservation Initiative 2000)

	Big Quilcene River		
Return year	Natural	Hatchery	Total
1968	5,797		
1969	1,307		
1970	655		
1971	1,798		
1972	2,067		
1973	3,107		
1974	795		
1975	1,405		
1976	2,445		
1977	821		
1978	2,978		
1979	345		
1980	375		
1981	138		
1982	156		
1983	64		
1984	60		
1985	44		
1986	15		
1987	8		
1988	120		
1989	1		
1990	6		
1991	49		
1992	320	414	734
1993	97	50	147
1994	349	393	742
1995	4,029	498	4,527
1996	8,479	882	9,361
1997	7,339	657	7,996
1998	2,244	544	2,788

2.2.3) Progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for as many brood years as available.

Broodyear	Adults contributing	Hatchery release	Resulting runsize, number at age				Total resulting runsize	Recruits per spawner
			2 yr	3 yr	4 yr	5 yr		
1988	120	0			710	95	805	6.7
1989	1	0		24	25	10	59	59.0
1990	6	0	0	8	46	0	54	9.0
1991	49	0	8	680	189	0	877	17.9
1992	734	216,441	7	4,338	8,816	367	13,528	18.4
1993	136	24,784	0	370	490	14	874	6.4
1994	722	343,550	175	7,104	936	0	8,215	11.1
1995	4,527	441,167	35	1,831	1,172		>3,038	>0.7
1996	9,361	612,598	7	1,809			>1,816	0.2
1997	7,996	340,744	0					
1998	2,788	343,530						

2.2.4) Annual proportions of hatchery and natural fish on natural spawning grounds for as many years as possible.
The first 100% adipose-marked hatchery adults will return in 2000. The first year when all age classes of adipose-marked hatchery adults will be present is 2002**.**

2.2.5) Status of natural population relative to critical and viable population thresholds.
The natural population is currently healthy. At the inception of the supplementation program the population was critical.

2.3) Relationship to harvest objectives

The “base conservation” fishery total harvest rate as proposed under the Summer Chum Salmon Conservation Initiative is 10.5% (3.3% to 15.3%).

Annual fishery exploitation rates for Hood Canal/Strait of Juan de Fuca summer chum salmon. (Summer Chum Salmon Conservation Initiative 2000)

Return year	Canada, Area 20	U.S. pre-terminal	U.S. terminal	Total
1974	0.086	0.023	0.027	0.136
1975	0.034	0.019	0.319	0.373
1976	0.075	0.045	0.507	0.627
1977	0.049	0.042	0.266	0.358
1978	0.025	0.025	0.172	0.222
1979	0.057	0.098	0.156	0.311
1980	0.053	0.031	0.626	0.710
1981	0.131	0.095	0.368	0.595
1982	0.187	0.036	0.461	0.684
1983	0.006	0.059	0.688	0.753
1984	0.062	0.014	0.503	0.580
1985	0.336	0.101	0.311	0.749
1986	0.088	0.018	0.568	0.674
1987	0.063	0.024	0.722	0.809
1988	0.075	0.032	0.372	0.479
1989	0.432	0.081	0.354	0.866
1990	0.334	0.022	0.369	0.724
1991	0.185	0.088	0.388	0.661
1992	0.206	0.027	0.066	0.298
1993	0.044	0.065	0.023	0.133
1994	0.142	0.026	0.011	0.179
1995	0.042	0.006	0.003	0.052
1996	0.015	0.005	0.008	0.028
1997	0.019	0.004	0.019	0.043
1998	0.018	0.008	0.009	0.034

2.4) Relationship to habitat protection and recovery strategies.

Supplementation is conducted concurrent to and in accordance with the habitat plan chapters of the co-managers' Summer Chum Salmon Conservation Initiative, attachment 12A.

2.5) Ecological interactions

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give careful considerations to the unlisted but listable indigenous species.

Summer chum that are produced naturally in the Quilcene River and that are produced at the hatchery serve as prey for resident fishes in the local freshwater and estuarine systems. Predators likely include cutthroat trout, juvenile coho salmon and sculpin. During outdoor rearing at the hatchery, kingfishers and ouzels are common avian predators, but their impacts are unquantified, and their predation continues in the presence of industry standard control measures. Harbor seals may be significant predators on returning summer chum adults in Quilcene Bay.

Chum salmon are opportunistic feeders, and may prey on fish as sub-adults when in the ocean (Salo 1991). However, predation on wild-origin chum fry by juvenile, supplemented summer chum released at the life stage and time proposed is an unlikely event during their fresh or marine water migration period in Hood Canal and the Strait of Juan de Fuca. Juvenile chum salmon migrating out of Hood Canal at a size characteristic for hatchery-origin fish (> 45 mm) generally feed upon neritic zooplankton in open water areas, and fish of any life stage have not been shown to be an important prey item (Simenstad et al. 1980). In addition, salmonid predators prey on food items less than or equal to one-third of their length (Witty et al. 1995). The average size range for supplemented fed chum fry liberated at 390-450 fish per pound is 50-53 mm (Fuss 1997), compared to a size of 37-41 mm for newly emerged and migrating wild summer chum fry (Tynan 1997). Supplementation programs will continue to release summer chum at a target average size of 53 mm as a strategy to ensure that predation on wild fry is not likely.

Large concentrations of migrating juvenile or adult hatchery-origin summer chum originating from the proposed programs may attract predators (birds, fish, and seals) and consequently contribute indirectly to predation of wild fish (Steward and Bjornn 1990). The presence of large numbers of hatchery fish may also alter wild summer chum behavioral patterns, potentially influencing their vulnerability and susceptibility to predation. Alternatively, a mass of hatchery-origin summer chum migrating through an area may overwhelm established predator populations, providing a beneficial, protective effect to co-occurring wild-origin fish. Proposed juvenile release levels are of a small magnitude (< 500,000 fed fry per year) relative to the area into which the fish are being released (the marine waters of Hood Canal or the Strait of Juan de Fuca). Also, the hatchery-origin fish leave freshwater areas where they might intermingle at relatively high

densities with wild fish within hours post-release, and, due to their larger size, hatchery-origin fed fry will not likely migrate in the same estuarine areas as wild fry. It is unlikely that the release of hatchery summer chum will lead to an increased attraction of predators to wild fish.

Competition for food resources may occur between natural summer chum and hatchery summer chum, summer chum and pink salmon fry, and summer chum and hatchery fall chum released from other Hood Canal sources. The summer chum hatchery program intends to produce fry sufficiently large to feed in deeper water, offshore habitats, where competitive impacts with smaller, shoreline oriented, natural fry are reduced. Efforts have been undertaken to eliminate Hood Canal hatchery fall chum releases during the summer chum emigration period. Pink salmon are present in odd-numbered broodyears, are limited in numbers, and have co-evolved with the summer chum populations.

Hatchery-origin adults may compete with wild-origin chum for spawning sites or access to mates. This interaction is not viewed as negative in the context of this plan, as intermixing between supplemented and wild broodstock of the same stock on the spawning grounds is an anticipated and desirable consequence of the supplementation program. This inter-mixing on the spawning grounds meets the objective of the supplementation program of increasing natural production in the region. Straying of non-indigenous, supplemented adult summer chum between watersheds is not expected to be a significant concern regarding competition. Naturally-produced chum may exhibit straying levels ranging from 2-46 % (Tallman and Healey 1994). However, hatchery-origin chum salmon in Hood Canal have demonstrated a high fidelity for their stream of origin (Fuss and Hopley 1991; WDFW data for QNFH-origin marked summer chum 1997). In addition, selective breeding that may occur in hatcheries using gametes from returned migrants has been shown to result in a decrease in straying with time (Tallman and Healey 1994).

Coho and fall chum spawn in the Quilcene River after summer chum have spawned. The extent and areas of natural coho spawning are undocumented and need examination. Fall chum spawn in large numbers, in November and December, when flows are greatly increased over flows during the summer chum spawning period. Under these higher flow conditions, fall chum have spawning areas available that were dry during the summer chum spawning period, reducing the level of redd superimposition. The race of fall chum in the Big Quilcene River generally emerges from the gravel and migrates to the estuary after the period of summer chum emigration.

Under certain conditions, hatchery effluent has the potential to transport fish pathogens out of the hatchery, where natural fish may be exposed to infection. Interactions between hatchery fish and natural fish in the environment may also result in the transmission of pathogens, if either the hatchery or natural fish are harboring a fish disease. This latter impact may occur in watersheds where hatchery fish are planted and throughout the freshwater and marine migration corridor where hatchery and wild fish may interact.

As the pathogens responsible for fish diseases are present in both hatchery and natural populations, there is some uncertainty associated with determining the source of the pathogen (Williams and Amend 1976, Hastein and Lindstad 1991). Hatchery-origin fish may have an increased risk of carrying fish disease pathogens because of relatively high rearing densities that the fish are subjected to in the hatcheries and resultant stresses to the fish. Under natural, low density conditions, most pathogens do not lead to a disease outbreak. When fish disease outbreaks do occur, they are often triggered by stressful hatchery rearing conditions, or by a deleterious change in the environment (Saunders 1991). Consequently, it is possible that the release of hatchery fish may lead to the loss of natural fish, if the hatchery fish are carrying a pathogen, if that pathogen is transferred to the natural fish, and if the transfer of the pathogen leads to a disease outbreak. Although hatchery-origin populations may be considered to be reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish (Steward and Bjornn 1990).

This project will be conducted in a manner consistent with Pacific Northwest Fish Health Protection Committee (1989) and Salmonid Disease Control Policy of the Fisheries Co-Managers (1992) guidelines. These guidelines define rearing, sanitation, and fish health practices that minimize the incidence of disease outbreaks in propagated populations, thereby decreasing the risk of fish pathogen transmission to co-occurring wild populations. All hatchery-origin fish will be inspected by USFWS fish pathologists to certify their disease status and health condition prior to liberation. The release of viable healthy summer chum smolts is promoted through compliance with these fish health maintenance guidelines.

SECTION 3. WATER SOURCE

Specify source (spring, well, surface, etc.), water quality profile, and any differences between hatchery water and water used by the naturally spawning population.

Penny Creek, a tributary to the Big Quilcene River, is used for incubation and early rearing. The water temperature is slightly higher than the Big Quilcene River, but exhibits a naturally varying seasonal and diurnal temperature profile. Later hatchery rearing stages, in the weeks before release, are completed on mixed Big Quilcene/Penny Creek water. Water temperature measurements were made in 1992 to compare the hatchery water source with the temperature in the river. From September 1 through November 30, the hatchery supply averaged 10.67 ºC (SD = 2.40) and the mean Big Quilcene River temperature measured at the hatchery and at Linger Longer Bridge averaged 9.80 ºC (SD = 2.33).

SECTION 4. FACILITIES

Provide descriptions of the physical plants listed in this section, and three additional sets of information.

The hatchery has three water sources for fish production, Big Quilcene River, Penny Creek, and a saltwater well. Maximum withdrawals from each source are regulated by the Washington State Department of Ecology under surface water rights certificates:

S2-07466C for 15 cubic feet per second (cfs) from the Big Quilcene,
S2-28179 for 25 cfs from the Big Quilcene River
S2-01218C for 10 cfs from Penny Creek,
S2-10233 for 15 cfs from Penny Creek,

and ground water right # G2-28147 for 185 gallons per minute from a salt well.

Penny Creek is the only water source for incubation and early rearing in the hatchery building. Water is obtained from a small dam and two intake structures. One intake feeds a 24" pipeline to a distribution manifold in the hatchery building. The other intake structure feeds a 30" pipeline supplying Penny Creek water to the raceway banks.

Big Quilcene River is the primary water source for outdoor rearing in the raceways. Two intake structures 0.5 mile upriver from the hatchery supply water via a 30" pipeline to a sediment settling basin and rotating drum screens that exclude gravel, leaves, and fish from the raceway supply piping. First-pass Big Quilcene River water is available for all raceways. Through a combination of overflow collection boxes and valving, water previously used in raceway banks can be re-used in several combinations. The saltwater well supplies only a limited amount of water and is used in the fall and springtime to alleviate stress as the fish approach smoltification. Fish waste is removed from the raceways by lowering water levels and brushing pond bottoms. Water drained during this process is removed via a drain piping system separate from the rearing water outfall that conveys waste water to a retention and settling basin. Waste water discharges are monitored for settleable solids and suspended solids, as specified under NPDES discharge permit WA-187-2.

Outdoor rearing raceways are concrete and are arranged in two "decks", each consisting of two "banks". The upper deck consists of bank A, with eleven 8'x80' raceways and bank B, with ten 8'x80' raceways. The lower deck consists of banks C and D, each with nine 8'x80' raceways. Water is delivered by underground piping that feeds a headbox at the upper end of each bank. Wooden damboards at the head of each raceway regulate the water height in the headbox. Holes drilled in the upper damboards serve as water entry points to the raceway. Flows into the raceways are determined by the number of holes in the damboard and the water depth in the headbox. Water exiting the raceways spills over damboards at the tail end into a collection box that receives water from all raceways in a bank. From the collection box the water can be re-used on lower groups of raceways or returned to the river via a drainline. Water re-use is possible in the following configurations: A **ö** B, A **ö** D, B **ö** D, A+B **ö** D, C **ö** D, or A+B+C **ö** D. Summer chum are

reared in bank C on “single-pass” water, i.e. water is not re-used in during the summer chum culture period.

One, for programs that directly take listed fish for use as brood stock, provide detailed information on catastrophe management, including safeguards against equipment failure, water loss, flooding, or other events that could lead to a high mortality of listed fish.
Trained project personnel live on-station to quickly respond to emergencies. Water supplies are monitored with radio response and dial-up alarm systems. Water is supplied by gravity flow, so it is safe from power outages.

Two, describe any instance where construction or operation of the physical plant results in destruction or adverse modification of critical habitat designated for the listed species.
None.

Three, describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.
None.

4.1) Brood stock collection
Adult salmon enter the fish hatchery via a concrete fish ladder supplied by production rearing water that is leaving the hatchery. The ladder entrance is positioned at the end of a graduated field electric weir that spans the river. The weir was constructed by Smith-Root Co. in 1989 and forms an electro-mechanical barrier to fish passage.

4.2) Spawning
(See 4.1)

4.3) Incubation
Fertilized eggs are incubated to the eyed stage in wire baskets suspended in hatching troughs. Once eyed, the eggs are shocked, picked, and incubated to swim-up in vertical stack Heath incubators.

4.4) Rearing
When the hatched fry reach the swim-up stage, when the yolk-sac is fully absorbed, the fry are placed in rectangular fiberglass rearing troughs. Feeding is initiated using automatic belt feeders, which reduces human contact. When the fry have grown large enough for adipose fin marking, they are processed through the marking trailer and are moved outdoors to rearing Bank C for final rearing.

4.5) Acclimation/release
(See 4.4)

4.6) Other None.

SECTION 5. ORIGIN AND IDENTITY OF BROOD STOCK

5.1) Source

Natural spawning adults returning to the Big Quilcene River and Quilcene Bay.

5.2) Supporting information

5.2.1) History

Provide a brief narrative history of the brood stock sources. For natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.5 if appropriate). For existing hatchery stocks, include information on how and when they were founded, and sources of brood stock since founding. If stock crosses, list stock of each sex.

5.2.2) Annual size

Quilcene National Fish Hatchery Summer Chum Supplementation program data - 1992-2000

Brood Year	Broodstock Removals/Swim-ins # Males	# Females	Total	Natural Spawners	Percent Removed	# Fed Fry released	Release Size (gms)	Release Dates
1992	225	186	411	320	56.4%	216,441	1.05	4/13/93
1993	19	17	36	97	34.0%	24,784	1.46	3/30/94
1994	169	178	347	349	53.0%	343,550	1.06	3/27/95
1995	228	256	484	4,029	11.0%	441,167	1.06	3/27/96
1996	438	333	771	8,479	9.4%	612,598 1/	1.34	4/10/97
1997	274	261	535	7,339	8.2%	340,744 1/	1.62	4/2, 4/15/98
1998	282	220	544	2,247	19.5%	343,530 1/	1.28	3/8, 3/22, 4/2/99
1999	81	89	170	2,811	5.7%	181,711 1/	1.03	3/9, 3/24/00

1/ Figures do not include fish and eggs transferred to Big Beef Creek

Quilcene National Fish Hatchery Summer Chum transferred to Big Beef Creek.

Brood Year	Transfer dates	Eggs	Fish
1996	11/8, 11/14/96, 1/16/97	168,000	40,000
1997	10/24, 11/28/97	157,000	0
1998	10/23, 11/5, 11/12, 11/19/98	217,465	0
1999	11/10/99	40,298	0

Include past brood stock sizes as well as proposed future sizes. Specify number of each sex, or total number and sex ratio, if known. For natural population brood stocks, explain how their use will affect their population status relative to critical and viable thresholds.

As a supplementation program, use of natural broodstocks will intentionally increase their numbers, resulting in recovery of the population.

5.2.3) Past and proposed level of natural fish in brood stock.
If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the brood stock annually.
The supplementation program was begun in 1992 with 100% natural indigenous broodstock. Returns of hatchery-released fish began in 1995. Subsequent brood composition is not positively identifiable, nor reliably estimated.

5.2.4) Genetic or ecological differences
None

5.2.5) Reasons for choosing
Big Quilcene River - local wild stock used as brood
Big Beef Creek - Big Quilcene used since it is the nearest donor stock, with similar timing and equivalent latitude.

5.3) Unknowns
Identify areas where a lack of data leads to uncertainties about the choice of brood stock.
None

SECTION 6. BROOD STOCK COLLECTION

Describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

6.1) Prioritized goals

List in order of priority the general goals for brood stock collection. Refer to sections 1.5 and 1.6.

(1) the summer chum program will attempt to rebuild the run from the existing low level while preserving its genetic character;

(2) the duration of the supplementation program will be limited to a maximum of three chum salmon generations
(12 years) to minimize the likelihood for divergence between hatchery broodstocks and target natural stocks;

(3) brood stock will be captured in the Big Quilcene River and in Quilcene Bay;

(4) at least half of the adults returning to Quilcene Bay in any given year will be allowed to escape to spawn naturally;

(5) adults captured for broodstock will be collected so that they represent an unbiased sample of the naturally spawning donor population with respect to run timing, size, age, sex ratio, and any other traits identified as important for long term fitness. Special emphasis will be placed on ensuring that the age group structure and sex ratio of collections are as similar as possible to those of adult returns of the founding population for the given week of the run;

(6) Spawning protocols, including collection of broodstock proportionally across the breadth of the natural return, randomizing matings with respect to size and phenotypic traits, application of at least 1:1 male-female mating schemes, and avoidance of intentional selection for any life history or morphological trait, will be applied that ensure that hatchery broodstocks represent wild stock diversity. Spawning protocols will equalize as much as possible the contributions of parents to the next breeding generation

(7) Returning adults produced by the supplementation program will be used, with natural chum, as broodstock over the duration of the program (9 years post initial return of three year olds). The three generation limit for the duration of a program is intended to address the concern that repeated enhancement of the same population segment will result in a decrease in effective population size. It also limits to a few generations, the exposure of natural fish to the selective effects of hatchery conditions (i.e. domestication effects);

(8) brood stock will be sampled for GSI, scales, other biological characters, and for disease assessment purposes.

6.2) Supporting information

6.2.1) Proposed number of each sex.
250 males; 200 from the bay fishery, 50 from the hatchery rack
250 females; 200 from the bay fishery, 50 from the hatchery rack

6.2.2) Life-history stage to be collected (e.g., eggs, adults, etc.)
Adults

6.2.3) Collection or sampling design
Include information on the location, time, and method of capture. Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired brood stock source. Also, describe the method of capture (e.g. weir trap, beach seine, etc.) and quantify as take handling, behavior modification, stress, or mortality of listed fish.
Beach seine captures depend on the local coho fishery which begins the last week of

August. Brood collections are done through September. The hatchery weir is in continuous operation from mid-August through December for summer chum, coho, and fall chum broodstock collection.

Estimated annual take profile for summer chum

Source	Mortality, gametes lost	Mortality, gametes into supplementation program	Handled	Transported
Fishery, during attended brood collection	50	0	800*	400
Hatchery weir	0	0	100	n/a
Hatchery holding	20	0	480	n/a
Hatchery spawning	5	475	1,000**	n/a

* many fish are handled and returned alive to Quilcene Bay
** adults are handled repeatedly to sort for ripeness.

6.2.4) Identity

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

Big Quilcene River and Little Quilcene River summer chum are mixed in Quilcene Bay. The two populations are considered as one stock. Known hatchery fish (from adipose clipping) will not be positively identifiable until 2000 and beyond.

6.2.5) Holding

Describe procedures for holding fish, especially if captured unripe or as juveniles. Quantify as take trapping, holding, stress or mortality of listed fish.

Adults are held in a covered concrete raceway at the hatchery until ripe for spawning. Spawning usually occurs within one week of capture.

6.2.6) Disposition of carcasses

Scale samples are taken from adults, carcasses are made available for GSI sampling, or frozen for later sampling. When sufficient samples are taken, excess carcasses are buried on the hatchery grounds.

6.3) Unknowns

Identify any data gaps that lead to uncertainties about brood stock collection. None

SECTION 7. MATING

Describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

7.1) Selection method

The donor stock used for the supplementation program is derived from the indigenous summer chum population within Quilcene Bay. For reintroductions, donor stocks selected will be those that are geographically nearest the targeted stream, and that show the greatest similarity in genetic lineage, life history patterns, and ecology to the extirpated population. Donor stocks selected for reintroduction will only be used at one location.

Summer chum adults are collected from Quilcene Bay and the hatchery rack across the breadth of the freshwater return period (mid August through October 15), at weekly levels proportional to average escapement timings for the returning population. Methods used to collect broodstock are as follows:

- snorkel survey/block seine collection within freshwater fish migration and holding areas; and
- selective fishery (e.g. beach seine) removal in the targeted stream, or in extreme terminal marine areas immediately adjacent to the mouth of the target stream.
- voluntary entry to the hatchery via the weir and fish ladder.

Collected fish are transferred as soon as possible from floating live-cars and adult holding tubes to the hatchery holding and spawning facilities. During all capture, holding and handling phases, fish are handled with the utmost care, ensuring that harm to the fish, including the duration that chum are out of water, is kept to a minimum.

At spawning, ripe fish are randomly paired. Adults that swim in to hatchery rack are purposely mated with adults captured in Quilcene Bay to avoid mating likely hatchery-origin fish with likely hatchery-origin fish**.**

Specify how spawners are chosen, e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, prioritized based on hatchery or natural origin, etc.

7.2) Males

Backup males are not used, repeat spawning and matrix spawning are used only when insufficient numbers of adults are present to achieve one-on-one spawning.
Specify expected use of backup males and repeat spawners.

7.3) Fertilization

The main goals for the breeding of summer chum are for every adult to contribute, and for the genetic contribution from each fish to the population to be as equal as possible

(Phelps 1993). These goals include the desire to minimize loss of alleles and to maintain the heterozygosity present in the existing wild populations. In meeting these goals, spawning protocols are applied that ensure that contributing broodstocks are representative of wild stock diversity. Fish spawned represent the breadth of the summer chum return, in timing and proportion by timing. The entire August through October span of the return is represented in spawning, to the extent feasible.

Mating schemes used in all summer chum supplementation programs have the objective of incorporating at least 1:1 male-female spawning ratios. Given the preceding goals, and the parameters regarding run timing representation, all matings are randomized with respect to fish age, size, and phenotypic traits. Intentional selection of any particular trait in the use of spawners, including age, size, and other morphological characters, is avoided.

Fertilized eggs are water hardened and surface disinfected for 30 minutes in 75 ppm iodophor solution. They are incubated in baskets set in troughs on ambient Penny Creek water, which ranges in temperature seasonally from 6/ to 12/C.

Adult summer chum are monitored for viral and bacterial pathogens as specified by the co-Managers' Fish Health Policy.

Describe fertilization scheme, such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or some other. Explain any fish health procedures used for disease prevention.

7.4) Cryopreserved gametes

no cryopreservation used

7.5) Unknowns

Identify any data gaps that lead to uncertainty in mating protocols.

None

SECTION 8. REARING AND INCUBATION

Provide current and previous goals and data. Include historic data for three generations or for years dependable data are available. Also, describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

INCUBATION:

8.1) Loading density

Include description of the incubator(refer to Section 4.4). Also, provide measurement of egg size.

Fertilized eggs are incubated to the eyed stage in wire baskets suspended in hatching troughs. Once eyed, the eggs are shocked, picked, and incubated to swim-up in vertical stack Heath incubators. Incubator trays contain substrate to support the sac-fry during yolk-sac absorption.

Heath trays are loaded at a maximum density of 4,000 eyed eggs. Flows into Heath stacks are maintained at 4 gallons per minute to provide the most suitable environment to reduce bacterial loads.

8.2) Influent and effluent gas concentration

(Dissolved Oxygen, and any other parameters monitored)

not measured, no oxygen problems encountered

8.3) Ponding

Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

Broodyear	Mean spawn date	Mean hatch date	Mean ponding date
1992	Sept 17	Nov 12	Jan 16
1993	Sept 23	Nov 21	Jan 20
1994	Sept 21	Nov 19	Jan 18
1995	Sept 18	Nov 10	Dec 31
1996	Sept 16	Nov 11	Jan 23
1997	Sept 23	Nov 16	Jan 25
1998	Sept 20	Nov 8	Jan 12
1999	Sept 24	Nov 25	Jan 29

Quilcene NFH summer chum temperature unit data, TU = 3BC

Broodyear	TU, spawn to hatch	mean BC (std dev)	TU spawn to ponding	mean BC (std dev)
1992	652	11.63 (1.69)	1,001	8.27 (3.50)

Ponding is forced, into indoor tanks. When the fish are adipose-clipped, they are moved from the indoor tanks, through the tagging trailer, then outdoors to concrete hatchery raceways**.**

8.4) Fish Health monitoring

Describe any diseases, yolk-sac malformation, and mortality.

The only losses to disease were in the first year of the program, when bacterial gill disease became a problem in lower flow tanks. Gill bacteria (*Flavobacterium brachiophilus*) are present every year, but are controlled with improved flow

management. Causative agents for furunculosis (*Aeromonas salmonicida*) and bacterial kidney disease (*Renibacterium salmoninarum*) are commonly isolated from returning adults, but have not been isolated from hatchery reared juveniles.

REARING:

Once they reach the swim-up stage, the fry are moved to indoor tanks for initial feeding. After initial feeding is established, they are moved to outdoor raceways for further growth. Feeding rates average 2.5% body weight per day. BioMoist is fed from swim-up through release, up to the 1.3 mm granule.

8.5) Density and loading.

Include a description of the rearing containers, such as start tanks, circulation, circulating ponds, flow through, etc. Refer to section 4.4.

Hatchery rearing densities will be those that yield the highest number survivals. Given that the actual identification of such densities is not likely, given current available data, the following conservative "standard" and "maximum" pond loading densities will be applied in all proposed supplementation programs to promote the release of healthy, viable fish (S. Evans and T. Tynan, WDFW, pers. com. Feb. `98):

	Pounds fish/gpm inflow		**Pounds fish/ft3 rearing volume**	
Chum size	Standard	Max.	Standard	Max.
Swim-up	<1.0	1.5	0.5	0.75
1200-600/lb	1.0	2.5	1.0	2.0
600-400/lb	1.5	3.0	1.0	2.0

Accurate estimates of the biomass of the rearing population allow for the calculation of pond densities. Weight samples are taken bi-weekly to determine average fish size to be applied to inventoried numbers of fish in deriving biomass estimates.

To allow for estimation of spawning ground return rates, contribution rates to extreme terminal area fisheries, and differentiation from natural-origin fish, all summer chum released at Quilcene NFH will be marked with an adipose fin clip. Marking will occur at least one week before release.

8.6) Influent and effluent gas concentrations

(oxygen, carbon dioxide, total gas pressure).

not measured, no perceived oxygen problems

8.7) Length, weight, and condition factor.

Temporal fish size data is available from hatchery records, summary is under development.

8.8) Growth rate, energy reserves

Temporal fish size data is available from hatchery records, summary is under development.

(hepatosomatic index - liver weight/body weight) and body moisture content as an estimate of body fat concentration.

8.9) Food type and amount fed, and estimates of feed conversion efficiency.

Summer chum fry are fed the BioMoist commercial diet.

Chum size	Feed Size
Swim-up	#1
1200-600/lb	#1 or #2, 1/32"
600-350/lb	#2 or 1/32"

Care is taken to avoid over-feeding, which can lead to a degraded rearing environment, which in turn can lead to bacterial gill disease. At all times, daily feeding rates will be maintained below ***0.10*** pounds feed per gallon per minute pond inflow per day to minimize gill irritation, and to guard against bacterial gill disease out-breaks.

8.10) Health and disease monitoring.

Rearing ponds and screens are maintained in a manner that ensures a hygienic environment for summer chum production. Mortalities are removed and enumerated at least daily to allow for monitoring of population size and fish health status. Rearing units are routinely cleaned to remove accumulated fish waste and uneaten feed. Troughs and tanks used for rearing are cleaned daily, and raceways are cleaned at least three times per week in a manner that does not re-suspend wastes into the water column where rearing fish may be adversely affected. The frequency of rearing unit cleaning is balanced to minimize disturbance to the fish.

All summer chum are reared under the guidance of certified fish health personnel and in accordance with the Co-Manager's Fish Health Policy (1992). Fish are monitored daily during rearing for signs of disease, through observations of feeding behavior and monitoring of daily mortality trends. Preferred and maximum pond loading and feeding parameters are adhered to at all times. Summer chum are examined by a fish pathologist within three weeks prior to release to determine fish health status.

8.11) Smolt development indices, if applicable

none measured

(e.g. gill ATPase activity).

8.12) Use of "natural" rearing methods.

Ambient water temperatures, natural ambient photoperiod, eroded raceway surfaces simulate natural rearing gravels.

8.13) Unknowns

Describe data gaps that lead to uncertainty in the incubation and rearing protocols.

None

SECTION 9. RELEASE

Provide current and previous goals and data. Include historic data for three generations or for years dependable data are available. Also, describe any inconsistencies with standards and guidelines provided in any ESU-wide hatchery plan approved by the co-managers and NMFS.

9.1) Life history stage, size, and age at release.

Fish liberation strategies are designed to release fry of a size and condition, and at a time that will maximize freshwater exodus rates, maximize survival from the river to the estuary, maximize survival during estuarine migration, and maximize survival to adult return. Actively migrating summer chum smolts averaging 1.26 grams have been released at Quilcene NFH with high apparent adult return rates.

9.2) Life history stage, size and age of natural fish of same species in release area at time of release.

Same as hatchery fish, or slightly smaller.

9.3) Dates of release and release protocols.

Releases from Quilcene NFH are forced, in the evening, timed to coincide with a flooding high tide.

9.4) Location(s) of release.

At Quilcene NFH from raceway discharge piping.

9.5) Acclimation procedures.

The final rearing phase is conducted on mixed Big Quilcene/Penny Creek water

9.6) Number of fish released

Quilcene National Fish Hatchery Summer Chum Supplementation program data - 1992-99

Brood Year	Broodstock Removals/Swim-ins # Males	# Females	Total	Natural Spawners	Percent Removed	# Fed Fry released	Release Size (gms)	Release Date
1992	225	186	411	320	56.4%	216,441	1.05	4/13/93
1993	19	17	36	97	34.0%	24,784	1.46	3/30/94
1994	169	178	347	349	53.0%	343,550	1.06	3/27/95
1995	228	256	484	4,029	11.0%	441,167	1.06	3/27/96
1996	438	333	771	8,479	9.4%	612,598 1/	1.34	4/10/97
1997	274	261	535	7,339	8.2%	340,744 1/	1.62	4/2, 4/15/98
1998	282	220	544	2,244	19.5%	343,530 1/	1.28	3/8, 3/22, 4/2/99
1999	81	89	170	2,811	5.7%	181,711 1/	1.03	3/9, 3/24/00

1/ Figures do not include eggs and fish of Quilcene NFH origin transferred to Big Beef Creek.

9.7) Marks used to identify hatchery adults.

The 1992 brood was coded-wire tagged and adipose clipped (25% of production). The 1997 broods and later are 100% adipose clipped**.**

9.8) Unknowns

Describe data gaps that lead to uncertainty in the release protocols.

SECTION 10. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

The Monitoring and Evaluation Program addresses the following Elements:

1. The estimated contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process;
2. Changes in the genetic, phenotypic, or ecological characteristics of target and non-target populations affected by the supplementation program;
3. The need and methods for improvement of supplementation activities in order to meet program objectives, or the need to discontinue a program because of failure to meet objectives; and
4. Determination of when supplementation has succeeded and is no longer necessary for recovery.

Monitoring and evaluation of summer chum supplementation actions in the Big Quilcene River have been underway since 1992. Studies have included juvenile marking (adipose clip with coded-wire tag, adipose clip only) for fisheries contribution and survival evaluations, stream surveys to enumerate spawners and evaluate straying, genetic stock identification work, and

fishery interception monitoring. Broodstock collection and fish cultural practices have also been monitored and evaluated, including fish health monitoring and disease-status certification; monitoring of spawner age, sex ratio, fecundity, and length data; and egg, alevin, and fry mortality, size and growth monitoring. These studies and monitoring activities are expected to continue.

a) Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.
    1. All hatchery-origin summer chum fry will be marked with an adipose fin clip to allow for distinction from natural-origin fish upon return as adults in fisheries, at the hatchery rack, and on the spawning grounds.
    2. Spawning ground surveys will be conducted throughout the summer chum return to count spawners, and to collect information regarding fish origin according to adipose fin clip observation, and age class composition through scale sampling.
    3. The number of naturally spawning hatchery-origin summer chum that contribute to the supplemented population's annual escapement will be estimated.
    4. Escapements of nearby non-supplemented populations will be monitored to determine the level of straying of supplementation program-origin fish to those drainages.
    5. The total recruitment (fisheries contribution and escapement) of supplementation program origin chum will be estimated. Survival rate estimates of hatchery fish will be compared with estimates for wild fish to measure the effectiveness of each program.

b) Element 2: Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations presently affected by the supplementation program.

    1. Genetic stock identification (GSI) allozyme collections of summer chum spawners will be continued for comparison with past collections to monitor changes in allelic characteristics, and with the intent to assess whether the supplementation program has negatively affected the genetic diversity of natural populations.
    2. DNA samples will be collected and archived for future analysis.
    3. Natural spawner abundance and distribution of wild and hatchery-origin fish will be monitored. Spawner densities will be determined and locations of preferred areas identified. Annual and long-term changes in spawning distribution of the populations will be determined.
    4. Spawning ground distribution, timing, and use by hatchery-origin fish will be compared to traits exhibited by wild-origin spawners.

c) Element 3: Determine the need and methods for improvement of supplementation or reintroduction operations or, if warranted, the need to discontinue the program.
    1. All hatchery summer chum juveniles produced through the program will be adipose fin clipped to allow for assessments of contribution and natural origin recruitment rates.
    2. We will determine the fry survival for each program at various life stages by:
        a. Monitoring growth and feed conversion for summer chum fry.

b. Determining green egg to eyed egg, eyed egg to swim-up fry, and swim-up fry to released fry survival rates for summer chum.
c. Maintaining and compiling records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for chum broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for one gram fry.
d. Summarizing results of tasks for presentation in annual reports.
e. Identifing where the supplementation program is not meeting objectives, and make recommendations for improved fry production as needed.

3. We will determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish by:
   a. Monitoring operation of adult trapping operations, ensuring compliance with established broodstock collection protocols .
   b. Monitoring timing, duration, composition, and magnitude of the run.
   c. Collecting biological information on collection-related mortalities and determine causes of mortality, and use carcasses for genetic stock profile sampling, if possible.
   d. Summarizing results for presentation in annual reports and providing recommendations on means to improve broodstock collection, and refining protocols if needed for application in subsequent seasons.
4. We will monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists of the USFWS will monitor fish health.
   a. Fish health monitoring is conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.
   b. The incidence of viral pathogens in summer chum broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (WDFW 1996).
   c. Recommendations on fish cultural practices will be provided on a monthly basis, based upon the fish health condition of chum fry.
   d. Fish health monitoring results will be summarized in the annual report.

d). Element 4: Collect and evaluate information on adult returns.

This element will be addressed through consideration of the results of the above Elements, and through the collection of information required under adaptive management criteria used as the basis for determining when to stop a supplementation or reintroduction program.

1. We will collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock for use as baseline data to document any phenotypic changes in the populations.
2. Commencing with the first year of returns of progeny from known naturally-spawned, hatchery-origin summer chum, we will evaluate results of spawning ground surveys and age class data collections to:
    a. Estimate the abundance and trends in abundance of spawners;
    b. Estimate the proportion of the escapement comprised by chum of hatchery lineage, and of wild lineage;
    c. Through mark sampling, estimate brood year contribution for hatchery lineage and wild-origin fish.

    Using the above information, we can determine whether the population has declined, remained stable, or has been recovered to sustainable levels.
3. We will compare newly acquired electrophoretic analysis data reporting allele frequency variation of returning hatchery and wild fish with baseline genetic data to determine if there is evidence of a loss in genetic variation (not expected from random drift) that may have resulted from the supplementation program.

3. Annual Monitoring and Evaluation Report.

Annual reports describing monitoring and evaluation actions, findings and recommendations will be assembled for the supplementation program. The report will summarize data collected through monitoring and evaluation activities, provide an analysis of the data and an interpretation of results, and suggest mechanisms for applying revisions necessary to adjust ineffective or inefficient portions of the program. The annual report will be consistent in content, structure, and detail with annual reports currently required by NMFS for hatchery projects authorized for the incidental or direct take of ESA-listed species under Section 10 of the Act.

Annual monitoring and evaluation reports will be reviewed and evaluated by the Co-managers and USFWS to assess the effectiveness and effects of the supplementation and reintroduction programs. Adjustments that are needed, if any, will be discussed and implemented as determined to be necessary to meet the objectives of the summer chum recovery plan.

SECTION 11. RESEARCH

Provide the following information for any research programs conducted in association with the HGMP. Correlate with research described in any ESU hatchery plan approved by the co-managers and NMFS.

11.1) Objective or purpose

A. Determine run timing and presence of summer chum on spawning grounds**,** needed to gauge broodstock collection efforts for timing and scale.

B. Install and monitor scour chains to measure degree of gravel movement in the Big Quilcene River.

11.2) Cooperating and funding agencies

A. US Fish and Wildlife Service

B. US Fish and Wildlife Service

11.3) Principle investigator or project supervisor and staff

A. David Zajac

B. Roger Peters

11.4) Status of stock, particularly the group affected by project

A. & B. Healthy

11.5) Techniques: include capture methods, drugs, samples collected, tags applied

A. Streambanks are walked to determine presence and relative scale of summer chum escapement. Task is necessary to keep hatchery brood collection below the 50% of the run guideline when numbers of adults are limited.

B. Up to 5 stream transects with cable depth gauges are anchored in streambed. Regular measurements are made to monitor gravel deposition and scour.

11.6) Dates or time period in which research activity occurs

A. Mid-August to late-September, 2 or 3 surveys

B. Early August through April

11.7) Care and maintenance of live fish or eggs, holding duration, transport methods

A & B. - none

11.8) Level of take: number or range of fish handled, injured, or killed by sex, age, or size

A. Approximately 5% of escapement may be disturbed during surveys

B. Approximately 5% of escapement may be disturbed during surveys

11.9) Potential for / estimates of injury or mortality, and methods to reduce either

A & B - none

11.10) Alternative methods to achieve project objectives

A & B - none

11.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project

A & B - none

SECTION 12. ATTACHMENTS AND CITATIONS

Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

Attachment A. Summer Chum Salmon Conservation Initiative, April, 2000. An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region. Washington Department of Fish and Wildlife and Point No Point Treaty Tribes. *Not attached*

Citations

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Witty, K., C. Willis, and S.Cramer. 1995. A review of potential impacts of hatchery fish on naturally produced salmonids in the migration corridor of the Snake and Columbia rivers. Comprehensive Environmental Assessment - Final Report. S.P Cramer and Associates. Gresham, OR. 76 pp.

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Summer chum salmon ESU/Population: Hood Canal Summer Chum ESU / Quilcene stock Activity: Supplementation				
Location of hatchery: Quilcene National Dish Hatchery **Dates of activity: August -May Hatchery program operator: U.S. Fish and Wildlife Service**				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a) (*spawning ground surveys)			5% of total escapement	
Collect for transport b)				
Capture, handle, and release c)			800	
Capture, handle, tag/mark/tissue sample, and release d)				200
Removal (e.g. broodstock) e)			500	
Intentional lethal take f)				
Unintentional lethal take g)			25	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released into the natural environment.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild.
h. Other takes not identified above as a category.

Instructions:
1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.